INDUSTRIAL ASSESSMENT CENTER

ENERGY AND WASTE CONSERVATION / MANAGEMENT ASSISTANCE FOR INDUSTRY

A U.S. DEPARTMENT OF ENERGY SPONSORED PROGRAM

ENERGY AND WASTE ASSESSMENT REPORT

NO. 198

ASSESSMENT DATE: June 17, 1998

LOCATION: Shepherdsville, Kentucky 40165

PRINCIPAL PRODUCTS: Magazine Printing

S. I. C. CODE: 2752

REPORT DATE: August 7, 1998

**Sponsored by Rutgers, The State University of New Jersey,
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1. EXECUTIVE SUMMARY

Report No.: 198

S.I.C. Code: 2752 **Location**: Shepherdsville, KY 40165 **Assessment Date**: June 17, 1998

Principal Products: Magazine Printing

Annual production: 9000 titles/yr

Annual Sales: ~$75,000,000 **No. of Employees**: 1100 (includes office and administrative employees for this and a sister plant)

No. of Energy ARs: 2 **No. of Waste ARs**: 2 **No. of Productivity ARs**: 1

Energy C.S.: $51,342/yr **Waste C.S.**: $105,998/yr **Productivity C.S.**: $60,000/yr

Estimated Cost of the Assessment: $500

1.1. Utility Usage Summary

Utility consumption and the corresponding utility costs at this plant, for the twelve-month period from April 1997 through March 1998, consisted of the following:

Table 1.1-1: Annual Utility Usage Summary

Electricity			Natural Gas		Water		Sewer	
(kWh)	(kW)	($)	(ccf)	($)	(gallons)	($)	(gallons)	($)
20,174,240	3,987	976,408	323,461	160,058	7,044,500	N/A	7,044,500	N/A

The total energy used is equivalent to approximately 101,880 million BTUs/yr. Total energy costs for this period were $1,130,076/yr. Annual cost savings from implementation of the energy recommendations total $51,342/yr., which represents 4.5% of the total energy costs. Total estimated implementation cost is less than $47,640, giving an average simple payback of less than 12 months. The recommendations are summarized on the following page. Detailed information on these recommendations and estimation of savings are in Section 4, Assessment Recommendations (ARs).

Table 1.1-2: Summary of Energy Savings and Costs				
AR No.	**Current Practice**	**Proposed Action**	**Estimated Net Annual Savings**	
1	Electric power factor is very low.	Install capacitors to raise power factor.	Conserved Resource Investment: Net Savings: Payback Time:	Electricity $47,600 $45,615 ~1 yr
2	Compressors operate at 125 psig.	Reduce compressor operating pressure to 110 psig.	Conserved Resource Potential Conservation Demand Conservation Investment: Net Savings: Payback Time:	Electricity 448.5 MMbtu/yr 223.8 kW-months/yr $40 $5,727/yr <1 month

Note that the estimated total savings are based on the sum of the demand and energy cost savings for each energy source. These savings were calculated based on an estimated electricity cost of $14.18/MMBtu. Also, factored into these average costs were electric cost adjustment, and all other charges, including sales tax. A "law of diminishing returns" applies to the total cost savings. That is, the figure of $47,790 is based on the sum of the cost savings for each AR as if they were independent.

1.2. Waste Summary

The facility prints short run trade magazines with soy based ink, primarily on web fed presses. There is one sheet fed press for special projects. The primary wastes are plastic containers and bottles, cardboard, waste ink and solvent, glue, ink cans, spill absorbents, paper, and plastic wrap. Some waste ink is re-blended on-site and off-site to black ink. Wastes are summarized in **Table 1.2-1**.

The client receives annual revenue of $75,000,000 from printed magazines and annual revenue of $426,000 from recycling paper and corrugated, including, mill wrap and tubes. The facility disposes of 2,600 yd^3 of trash at an estimated cost of $26,793. The cost for water and sewage were not made available. The client estimated the average wastewater effluent as 19,300 gpd.

Potential Waste and Productivity Assessment Recommendations (ARs) are summarized in Table 1.2-2 and Table 1.2-3 respectively. Estimated waste reduction from implementing the suggested waste ARs could save the company 15,000 gal/yr of press solvent and eliminate off-site laundry services, for an annual savings of $105,998. The estimated increase in productivity from implementing the suggested productivity AR could reduce the amount of required operators in the labeling area, making them available elsewhere in the plant. This AR can result in annual savings of $60,000.

2. GENERAL BACKGROUND

2.1 Facility Description

The facility prints short run trade magazines. Figure 2.1-1 is simple facility layout of the plant, which has a total area of 250,000 ft^2. Approximately 500–500,000 copies of 9,000 titles are printed annually, generating $75 million/yr in sales.

The plant has about 1,100 total employees over three 8-hour shifts, 800 of which are hourly. The operating schedule is given in Table 2.1-1. Salaried employees serve both this and a sister plant. The average pay rate for production and maintenance personnel is $10/hr and $12/hr, respectively.. The plant operates 5-7 days/week, 52 weeks/yr. Due to heavy product demand during the first half of the year, there was a lot of overtime. The plant had been shut down only weekend. However, the need for overtime has diminished.

Table 2.1-1: Operating Schedule by Area

Area	Operating Schedule	Number of Operating Days	Total Operating Hours*
Office	8 hours/day	260 days/yr.	2,080 hrs/yr.
Production	24 hours/day	312 days/yr.	7,488 hrs/yr.

*Based on demand

The plant is a small quantity hazardous waste generator as a result of spent blanket wash and MEK. Air permits are required on all presses, and the client is in the process of filing a Title V permit. Environmental priorities and concerns include:

- Possible need for air pollution controls (probably incineration) to meet VOC and HAP requirements on Title V air permit
- Desire to reduce hazardous waste generation & status due to waste solvents - Even though solvent usage/production is low, total quantity will increase if production increases & waste generator status will thus increase
- POTW concerns – Tightening restrictions on silver and pH in effluent: Potential future BOD surcharges from discharging photo and plate processor chemical solutions

2.2 Process Description

A detailed description of the manufacturing process is given below. Particular emphasis is placed on individual operations and waste generation. Figure 2.2-1 is a simple facility layout and figure 2.2-2 is a process flow diagram for the client's printing operation.

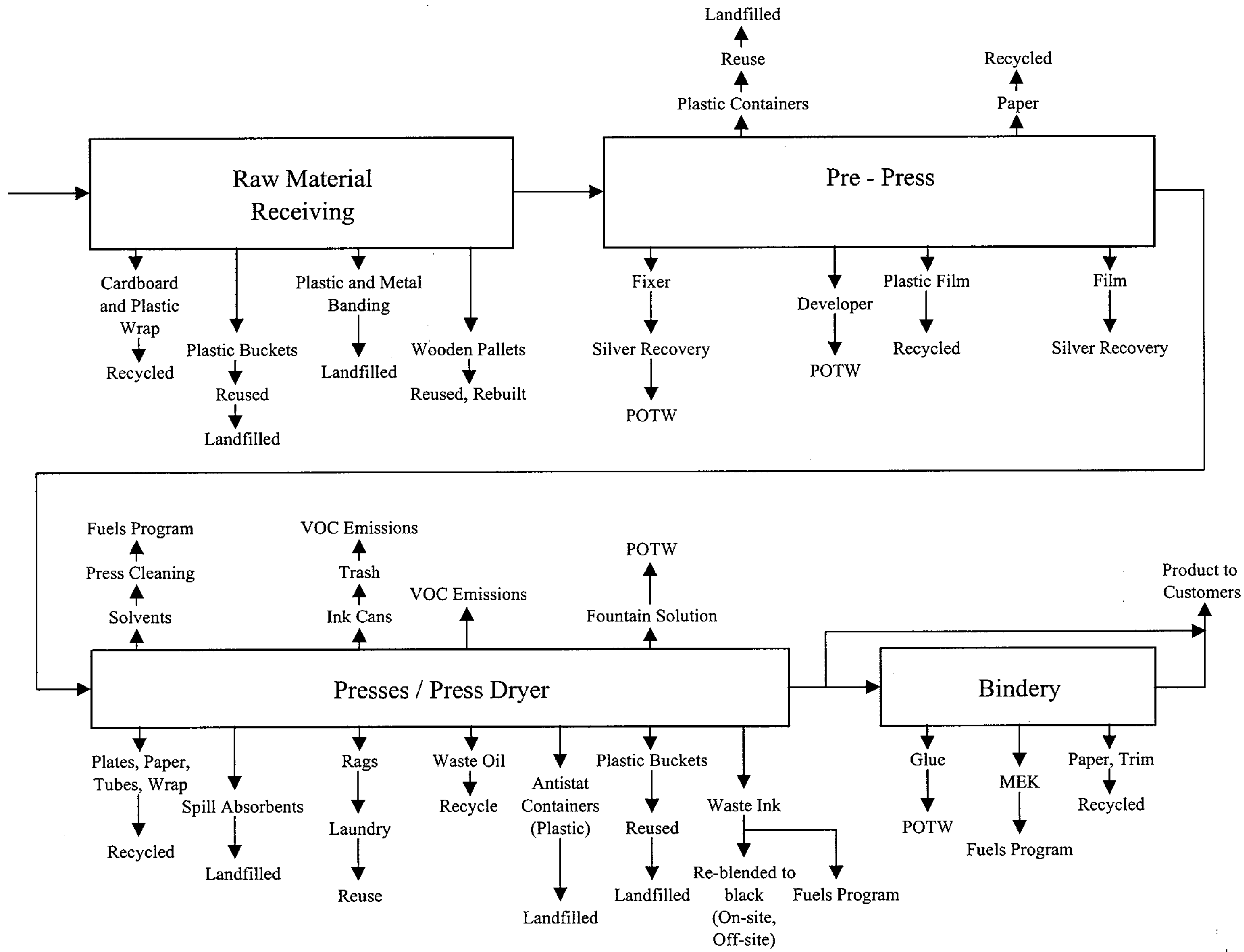


Figure 2.2-2 – Process Flow Diagram

2.2.1 Raw Materials Receiving

Raw materials are purchased by each department individually, mostly on an as needed basis. Except for paper rolls stored in the warehouse, all materials are stored in their respective department, e.g., pre-press.

Some customers provide their own paper. Paper is purchased when the price is down and excess is stored in the warehouse at the sister plant. Paper is received either as pre-cut sheets, or in web press rolls. Sheets come on wooden pallets secured by steel or plastic banding. Full and half rolls are on a cardboard core. Each roll costs approximately $5,000. Both sheets and rolls are wrapped in mill wrap (coated & uncoated), a moisture resistant paper that keeps the paper clean and dry. In addition to mill wrap, cardboard disks protect the ends of the top and bottom of the rolls. Copier paper arrives in boxes secured to pallets by steel banding and plastic wrap. All mill wrap, cardboard disks, paper cores, core plugs, end of roll, Mylar plastic and plastic wrap (baled or boxed) are compacted, baled, and recycled. Recyclers generally will not take coated mill wrap. But because they have so much recyclable paper and cardboard, their recycler does take it.

Metal caps are sawed off the end of cardboard rolls and landfilled. They are not recycled since the metal and cardboard is difficult to separate. Wood caps on the rolls (byproduct from paper manufacture) are given away and ground up for mulch. Steel and plastic banding is not recycled. Broken pallets are given to a pallet rebuilder to be bought back at a lower price than for new pallets. Pallets in good condition are reused for storage and shipping.

Pre-press chemicals are purchased on an as needed basis. Most pre-press chemicals come in plastic containers, which are reused internally. Concentrated fountain solution arrives in 320-gallon totes, which are recycled. All cardboard packaging is recycled. A total of 1.3 million pounds/yr of soy based ink is purchased primarily in 2,800 pound totes (black, yellow, blue, and red). Empty totes are picked up by the supplier and exchanged for full ones. A small percentage of ink, mostly specialty colors, is purchased in two and a half pound aluminum or steel tins. Empty tins are landfilled. **Storage of smaller cans appears to be haphazard and an unsafe assortment of materials. More effective racking and labeling is needed. A bar-coding system would be desirable for this.** Some PMS colors arrive in 5-gallon pails which are washed and reused. Unusable pails are collected in an open top dumpster for landfilling five to seven times a year. Empty drums, e.g., from solvent deliveries, are reused for waste ink, waste solvent and to ship dirty towels to the industrial laundry.

2.2.2 Pre-Press

Customer provided artwork comes into pre-press on film, computer disk, or as hard copy. Hard copy is put to film. Currently, 10% of customer provided art work is on disc, and the plant is moving almost entirely to digital pre-press, i.e., "direct computer to plate" technology. Artwork on film can be developed and transferred to computer via a scanner .

Technicians edit disk files to prepare them for the image setter. Then the image is exposed. The exposed film is developed and proofed, including a color key or match print proof. Even though the scanned image is now digital, a negative is used to provide better resolution. Once the negative meets customer color standards, it is ready to be stripped. Stripping is used to create a master proof on computer. The negative is placed on Mylar film and transferred to a light table where changes are made by "cutting and pasting". When the changes are complete, the master proof negative is processed to make a contact print. After developing and proofing, the image is burned onto a pre-sensitized aluminum plate, which is developed in an aqueous based plate processor. After developing, the plates are sent to the pressroom to begin the printing process.

Tap water is used in all processors. All film is silver based and silver is recovered electrolytically from fixer followed by backup iron displacement prior to POTW discharge. The silver recovery units are in the process of being upgraded so that secondary recovery can be eliminated and pH will meet POTW standards. The processors discharge by continuous overflow to the sewer after silver recovery. Plate developers are changed out every 4000 plates (about 2 wks.) and film processors are cleaned out quarterly. Photo chemicals dumping schedules were different in each pre-press area. Now all are consistently dumped every 3 months.

Waste photographic film also goes to a silver recycler, and all waste Mylar film is recycled

Fix and developer containers are reused for cleanout and fluid replacement. Extras are picked up by housekeeping and used by other departments. Pre-press doesn't like to use empty containers from other departments because of potential cross contamination.

2.2.3 Press

There are twelve presses; ten web-fed heat set presses (nine-color to two-color), one sheet fed press, and one web-offset press. Developed plates are mounted on cylinders on the presses. The printing area on the plate is hydrophobic, and fountain solution is used to wet the non-printing area of the plate. Two ounces of fountain solution are mixed with one gallon of reverse osmosis treated water. Disposable fabric filters, which are rinsed daily, are used in the chilled fountain reservoirs. Fountain solution is tested for pH and conductivity, and reservoirs are generally sewered weekly. The client switched from isopropyl alcohol based fountain solution to ethylene glycol based. However, in order to meet Title V requirements, they are now switching to propylene based solution.

Ink from the totes is pumped to the press fountains. A leaky pump was observed as shown in **Photo 1**. Water chilled rollers reduce VOC emissions during cleanup.

Paper rolls are then loaded onto the presses for printing, and a large amount of make-ready paper waste is generated during start-up. Operators adjust the color registers after visual inspection of the final product. The presses are run at a low speed during start up to align the color register and paper in the press, then increased to production speed. Make ready takes 20% of a run time (6-8 hrs.). White paper and ink-contaminated paper are segregated and manually collected and transported to the baler by forklift. A butler splices the ends of rolls together so that there is usually no "end of roll" waste. Any "end of roll" waste is either sent back on the roll to the paper company for revenue or recycled. Fabric softener (Downey) in consumer sized plastic bottles, is used to reduce static on the paper. The empty containers are trashed

All the presses have in-line folders and perforators. After printing, work in process is stacked by hand onto pallets, banded and sent to the bindery.

At the end of a job, residual ink is scooped from the inkwells and transferred to fifty-five gallon drums with screens on top to filter out debris. This ink is segregated by color. Uncontaminated ink is either reblended into black ink on-site or is sent back to the vendor for reclamation. As opposed to sheet fed ink, non-heatset web ink can be more easily recovered and recycled because it doesn't contain any drying agents. 5-8 drums/mo. are disposed as non-hazardous waste at a cost of $125/dm. Paper, dirt, and other contamination cause ink to be wasted. Some of this results from a job running over into the 2nd shift, where the operators remove the ink even though it could still be used.

Empty ink cans are reused internally until too cruddy. They are then filled with skins and contaminated paper, trashed and landfilled. The cans are not crushed.

Press blankets, which transfer ink from the plate to the paper, are manually washed with solvent wetted rags on all but one of the presses, which has an automatic blanket washer. **Solvent cans at each of the presses have lids, but the cans are often left open leading to evaporative losses, VOC emissions, and unnecessary worker exposure.** Blanket wash arrives in 550-gallon returnable totes and 55 gallon drums for the automatic blanket wash. The automatic blanket wash is pumped from the drum through the press and returned to the drum for recycle. A filter on the line from the drum removes contaminants and water. It is estimated that 1 drum of wash will be used every 1 to 2 weeks. Approximately 35,000 gallons of blanket wash (total), primarily isopropyl alcohol are used annually. The automatic blanket wash has a higher alcohol content than the other wash. It is more expensive, but less is used and it increases worker safety. It also decreases make ready time and reduces make ready waste.

Solvent wetted rags are placed in a drum with a screen in the bottom for draining solvent. The dirty rags are stored in a large container **(Photo 2)** for pickup by an industrial laundry service every 2 days. The laundry also supplies clean shop towels. The laundry imposes a charge for solvent retained in the rags; approximately 5 to 10 gallons per load drain out and 20-25 gals. are retained in the rags. Pigs are placed under the presses to absorb spills **(Photo 3)**. These absorbents are changed out every week, possibly indicating significant spillage or **not using the pigs to their maximum capacity**.

The air from the press dryers goes through an air cooled condenser to remove VOCs. This system is 87-89% efficient, depending on the ambient air temperature. A recycler charges for collecting the oil recovered in the condensate.

2.2.4 Bindery and Shipping

Once the printing job is done, it is sent to the bindery where one or more finishing steps may be performed. Products may be cut or trimmed to a specified size and folded. Products can be bound with staples in the saddle stitcher or the perfect binder which glues the spine together into a book form. There are 9 binders: 7 saddle stitch; and 2 glue, of which one is perfect bound. The bindery has two perfect binders and seven saddle stitchers. Empty spools from the saddle stitching material are presumably returned to the supplier.

Mail labels can be glued to the magazines or printed with an ink jet printer. Two types of glue are used; hot melt adhesive for binding and water based for mailing labels. No waste is generated from use of hot melt adhesive. Mail label gluing does generate waste. **The spigot on the glue storage tank is often left open, and the spilled/dripped glue overflows the catch bucket onto the floor where it hardens (Photo 4).** The glue remaining in the spigot also hardens and keeps the valve open. This recently led to a 300 gal. spill. Due to its location, the spigot is also sometimes hit by a forklift truck. Besides being a safety hazard and an eyesore, the floor must eventually be scraped and cleaned with MEK and alcohol during downtime. Pallets sometimes stick to the floor and must be scraped off.

Glue is applied by machine or manually. Glue wastes can accumulate when not all the glue is used up when a job is complete and the next job does not require labels, i.e., workers take too much glue. Excess glue and the tank overflow in the catch bucket was previously sewered and clogged the drains. It is now dried and drummed for incineration at a cost of $80-$150/dm. .If the glue begins to harden in the machine during a run, it is necessary to clean out the glue to ensure that the machine runs smoothly for the rest of the job. The plant is going towards more ink jet mail label printing and the water based glue will eventually become obsolete. Inkjet printer heads are cleaned with MEK from a safety can.

Paper waste from trimming and binding is automatically collected in a central cyclone system, baled, and recycled. The perfect binder grinds the backbones of its documents down before gluing. The grindings are also collected in the cyclone and recycled. Spillage from the baler **(Photo 5)** and trim on the floor is swept up to floor vents and transported to the baler. The various waste papers are segregated for baling and recycling. A higher price is received for baled white paper.

Though sampling is done at all production stages, prior to shipping each batch is checked for color, ink drops, straightness of backbone, pages folded over properly. Out of a batch of 500 copies, on average 15 copies are bad. Corrective forms are filled out depending on the number of rejects, but 15 is considered acceptable. Some rework can be done at the plant, e.g., trimming, folding. Otherwise both good and bad copies are sent to the customer, who has contracted for extra copies to make up for the defects. The customer previews the finished job before it is distributed.

After banding pallets by hand, some product is counted, boxed, and shrink-wrapped. The boxed material is placed on pallets for storage. Shipping is done at the sister plant, primarily through the US Postal Service using Post Office supplied mail bags, pallets, and totes. The customer pays the postage. The client hopes to go to a palletizer to eliminate the labor involved with manual filling of the bags.

2.2.5 Miscellaneous

- There are two 40 yd^3 dumpsters. The one for general trash is emptied approximately 65 times/yr., at total disposal cost of $26,793/yr.
- Empty 3.5 ink buckets are reused 4-7 times after washing in a bucket washer using high flash (150F) naptha. The bucket washer is claimed to save $25K/yr. The bucket washer is cleaned out monthly by a service, the sludge is disposed with the waste solvent, and fresh solvent provided. When the buckets become cracked or are otherwise falling apart, they are placed in a 30 yd. dumpster which is landfilled approximately 7 times per year at a total cost of $3,633/yr. The buckets are made of HDPE and should be recyclable, but might require shredding.
- A lot of operations throughout the plant seem to require worker bending and lifting. This is particularly true in the bindery where most of the workplace injuries occur. Workmen's compensation claims have been increasing.

2.2.6 Photographs

2.3 Major Energy Consuming Equipment.

The following list is an approximate summary of the major energy-consuming equipment at this facility.

1 **Electrical**

A. **Air Compressors**

The client has three 150 hp Gardner-Denver screw compressors. The compressed air is used for process equipment.

B **Lighting**

150 kW installed capacity.

2 **Natural Gas**

A. **Heating**

Natural gas is used through a plant-wide piping network for area heat.

B. **Press Drying Ovens**

Press ink is dried on-line with natural gas box ovens.

2.4 Energy Forms and Use in the Plant

Electricity is used for operating most process-related equipment, for lighting, and air compressors. Natural gas is used for heating and for the drying ovens on printing presses.

3. RESOURCE ACCOUNTING

3.1 Energy Accounting

An essential component of any energy management program is a continuing account of energy use and cost. Keeping up-to-date records of monthly energy consumption and associated costs can develop this. When utility bills are received, the energy use and costs should be recorded as soon as possible. A separate record will be required for each type of energy used, i.e., gas, electric, oil, etc. A combination will be necessary, for example, when both gas and oil are used interchangeably in a boiler. A single energy unit should be used to express the heating values of the various fuel sources so that a meaningful comparison of fuel types and fuel combinations can be made. The primary energy unit used in this report is the BTU, British Thermal Unit, or million BTU (MMBTU). The conversion factors are:

Table 3.1-1: Energy Unit Conversions

Energy Unit	Energy Equivalent
1 kWh	3,413 BTU
1 therm	100,000 BTU
1 cu. ft. natural gas	1,021 BTU
1 gallon No. 2 oil (diesel)	140,000 BTU*
1 gallon No. 6 oil	150,000 BTU*
1 gallon gasoline	130,000 BTU*
1 gallon propane	92,000 BTU*
1 ton coal	20,000,000 BTU*
1 hp-hr (electric)	2,545 BTU
1 hp-hr (boiler)	33,500 BTU

*Varies with supplier

The value of energy and cost records can be understood by examining the following facility data. The monthly building summary is shown in Table 3.1-2 and the monthly energy usage summary is shown in Table 3.1-3. Annual energy usage and costs are shown in Figures 3.1-1 and 3.1-2, and the components of the total electrical costs are shown in Figure 3.1-3. A pie chart, Figure 3.1-4, illustrates the percentage of energy use for various functions, and Figure 3.1-5 illustrates the percentage of energy costs for various functions. From these figures, trends and irregularities in energy usage and costs can be detected and the relative merits of energy conservation and load management can be assessed.

Besides plotting monthly energy consumption and cost, plotting the ratio of monthly energy consumption to monthly production may also be useful. An appropriate measure of production should be used that is consistent with the company's record-keeping procedures. The measure of production used can be gross sales, number of units produced or processed, pounds of raw material used, etc. The same period should be used for energy consumption and production.

Table 3.1-2:
Building Energy Summary

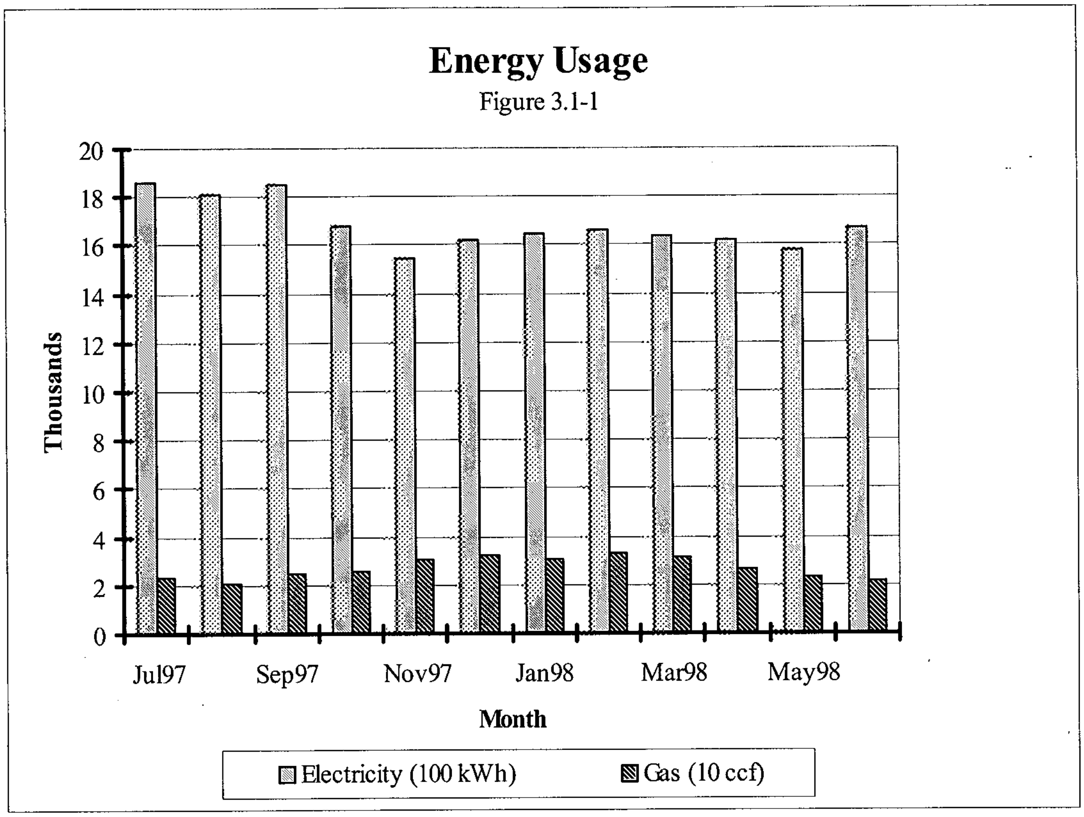
Month & Year	Elec. Usage Cost $/MMBtu	Elec. Demand Cost $/kW	Gas Usage Cost $/MMBtu	Elec. Usage Btu/ft²	Gas Usage Btu/ft²	Total Energy Usage Btu/ft²	Demand W/ft²	Elec. Usage Cost $/100ft²	Gas Usage Cost $/100ft²	Demand Cost $/100ft²	Facility Usage Cost* $/100ft²
Jul-97	7.92	11.52	4.53	25,359	9,465	34,824	15.95	20.08	4.29	18.37	24.37
Aug-97	7.92	11.52	4.35	24,721	8,521	33,242	15.74	19.58	3.71	18.14	23.28
Sep-97	7.92	11.52	4.34	25,305	10,096	35,402	15.48	20.04	4.38	17.83	24.42
Oct-97	7.92	8.73	4.34	22,959	10,307	33,267	14.70	18.18	4.48	12.84	22.66
Nov-97	7.92	8.73	5.50	21,140	12,611	33,751	13.95	16.74	6.94	12.19	23.68
Dec-97	7.92	8.73	5.75	22,087	13,199	35,285	14.08	17.49	7.60	12.30	25.09
Jan-98	7.92	8.73	5.75	22,409	12,511	34,920	14.15	17.75	7.20	12.36	24.95
Feb-98	7.92	8.73	5.23	22,644	13,480	36,123	13.88	17.93	7.05	12.13	24.98
Mar-98	7.92	8.73	5.12	22,318	12,745	35,064	14.39	17.68	6.53	12.57	24.21
Apr-98	7.92	8.73	4.62	22,166	10,712	32,878	14.31	17.56	4.95	12.50	22.51
May-98	7.92	8.74	3.78	21,542	9,511	31,053	15.34	17.06	3.60	13.40	20.66
Jun-98	7.92	11.52	3.69	22,768	8,943	31,711	15.47	18.03	3.30	17.82	21.34
Average	**7.92**	**9.72**	**4.85**	**22,952**	**11,008**	**33,960**	**14.79**	**18.18**	**5.34**	**14.37**	**23.51**

* Energy index is based on a facility size of 56,000 square feet.

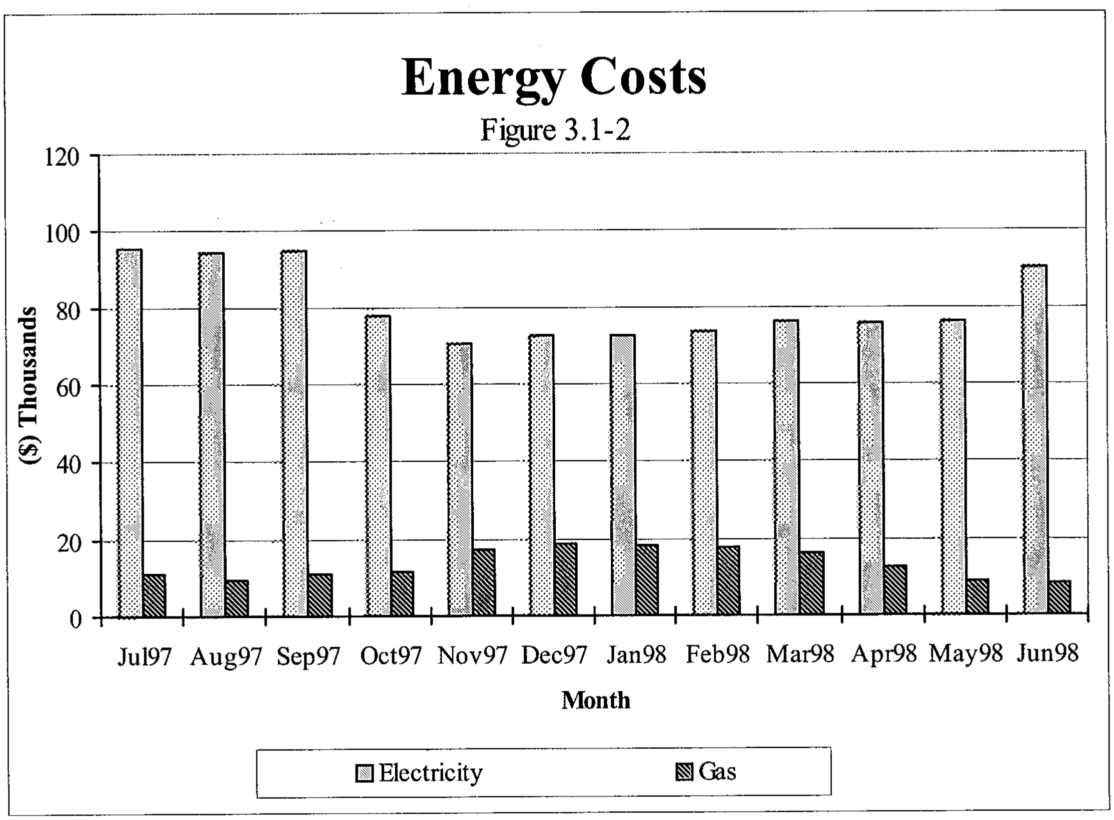
Table 3.1-3:
Energy Usage Summary

Month & Year	Electrical Usage (kWh)	Elec. Usage Cost ($)	Electrical Demand (kW)	Elec. Demand Cost ($)	Gas Usage (CCF)	Gas Usage Cost ($)	Other Charges* ($)
Jul-97	1,857,520	50,209	3,987	45,926	23,176	10,727	-627.53
Aug-97	1,810,800	48,946	3,936	45,340	20,864	9,267	123.33
Sep-97	1,853,600	50,103	3,871	44,585	24,722	10,949	506.16
Oct-97	1,681,760	45,458	3,675	32,100	25,238	11,196	29.03
Nov-97	1,548,480	41,855	3,488	30,466	30,879	17,356	-1,837.21
Dec-97	1,617,840	43,730	3,520	30,744	32,318	18,989	-2,101.20
Jan-98	1,641,440	44,368	3,538	30,904	30,635	18,000	-2,564.40
Feb-98	1,658,640	44,833	3,471	30,317	33,006	17,622	-1,450.65
Mar-98	1,634,800	44,189	3,598	31,426	31,208	16,328	402.49
Apr-98	1,623,680	43,888	3,578	31,253	26,228	12,379	351.93
May-98	1,577,920	42,651	3,834	33,493	23,289	8,992	96.55
Jun-98	1,667,760	45,080	3,867	44,541	21,898	8,259	681.42
Totals	**20,174,240**	**545,310**	**44,363**	**431,098**	**323,461**	**160,058**	**-6,390**

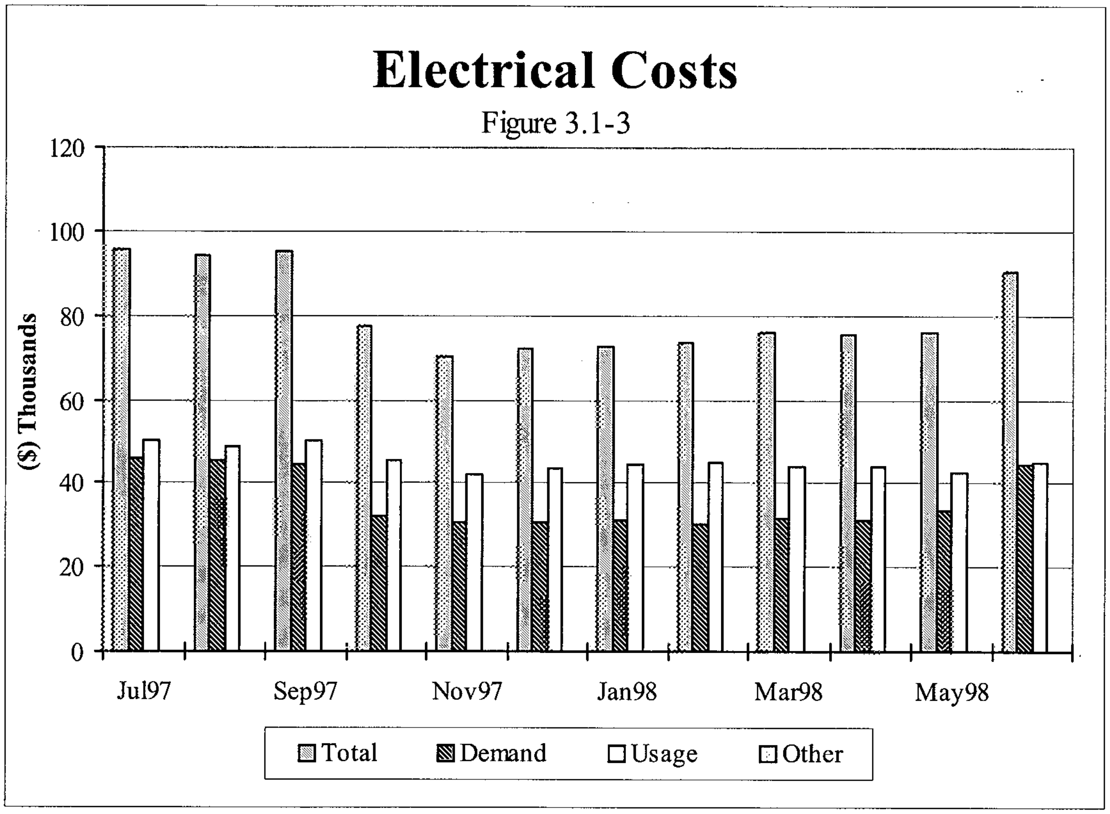
* Other charges include customer fees, late charges, credits, etc. for both gas and electric.

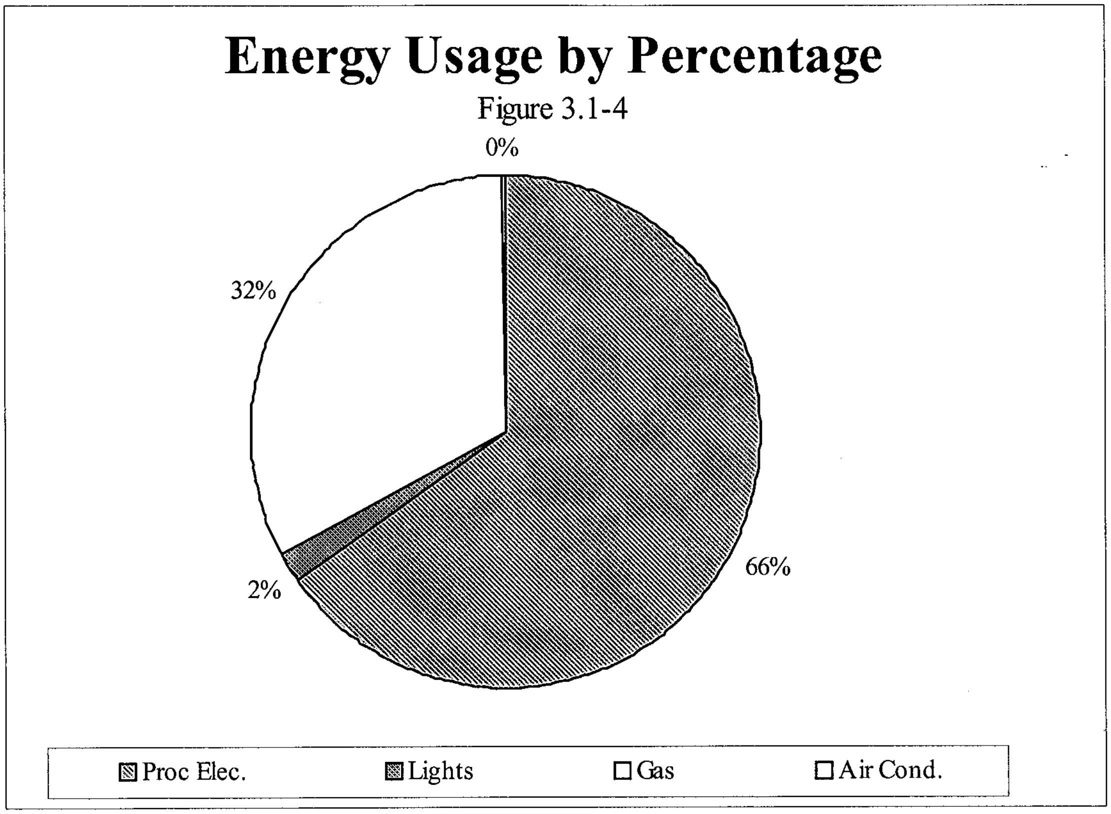


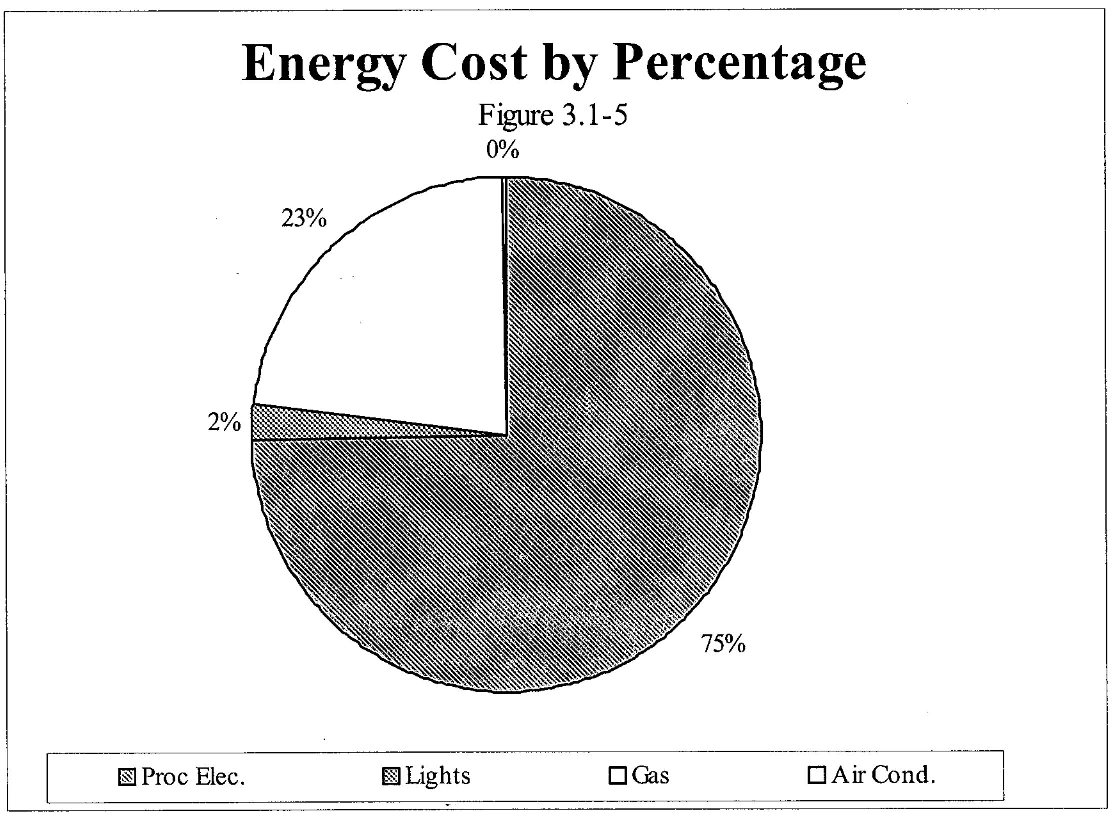
Energy Usage
Figure 3.1-1
20
18
16
14
12
10
8
6
4
2
0
Thousands
Jul97
Sep97
Nov97
Jan98
Mar98
May98
Month
Electricity (100 kWh)
Gas (10 ccf)



Energy Costs
Figure 3.1-2
120
100
80
60
40
20
0
($) Thousands
Jul97
Aug97
Sep97
Oct97
Nov97
Dec97
Jan98
Feb98
Mar98
Apr98
May98
Jun98
Month
Electricity
Gas


Electrical Costs
Figure 3.1-3
($) Thousands
120
100
80
60
40
20
0
Jul97
Sep97
Nov97
Jan98
Mar98
May98
Total
Demand
Usage
Other


Energy Usage by Percentage
Figure 3.1-4
0%
32%
2%
66%
Proc Elec.
Lights
Gas
Air Cond.


Energy Cost by Percentage
Figure 3.1-5
0%
23%
2%
75%
Proc Elec.
Lights
Gas
Air Cond.

4. ASSESSMENT RECOMMENDATIONS

4.1 Explanatory Notes

It should be noted that some of the assessment recommendations (ARs) might be interactive. In other words, if a given AR is implemented, the projected savings for the other ARs may differ from what is indicated. Therefore, if all of the ARs are implemented, the total related savings might differ from those listed in Table 1.2-1, Table 1.2-2, and Table 1.2-3. Furthermore, more than one AR may be presented for a specific situation, i.e., some ARs may be mutually exclusive. In the absence of clear choices, choosing the best alternative in this case is left to the client since they should best understand the impacts on their facility.

The order of magnitude of calculations used to estimate the simple payback period for each AR is included. Also, all of the data used in the calculations are shown so that the client may easily make changes or appropriate corrections. Estimations documented in the ARs are based upon information provided by the company or external sources, e.g., vendors, and observations made during the on-site visit. Engineering assumptions are made when necessary information is not readily available.

In reviewing the recommendations contained in this report, it should be noted that potential savings for waste ARs in most cases address only reduction and/or avoidance of material losses and waste disposal. Other waste management costs, such as record keeping, are not usually accounted for because of the uncertainty in allocating them to specific wastes. Furthermore, many of these costs are not readily attainable and are often unclear as they are often merged with other costs. Other savings not usually quantified in this study include elimination or reduction of a variety of possible future costs, such as those related to changing emissions standards and regulations and potential future liability, as well as improving general employee safety, health, and environmental quality.

ARs may require further sampling, analysis, or testing by plant personnel, equipment vendors, or consultants to verify anticipated performance. Some ARs may also be more speculative so that research and development may be appropriate, although these costs are usually not accounted for.